

3.0 Safety

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MaineDOT continually evaluates the safety needs of the state's transportation system. The Department's Work Plan incorporates both highway improvement projects that include safety features and dedicated projects that focus on an identified priority safety need. MaineDOT's approach to selecting safety projects will be covered in the next several pages.

In 2004, there were 35,226 crashes that resulted in 192 fatalities and 14,700 injuries. Police crash report data provides detailed information that enables assessment of future needs and past safety performance. A police report must be filed whenever a collision results in combined damage of \$1,000, bodily injury or death. MaineDOT maintains a database for all police-reported crashes that have occurred on all public roads since 1989. This section will discuss crash data for the 10-year period of 1995 through 2004 and provide an overview of Maine's recent crash performance, how it compares with national data, and cover leading crash trends. Engineering efforts are one key component to achieve improved road safety – but to fully address safety needs, other coordinated efforts are necessary in the areas of Enforcement, Driver Education and Emergency Services response. This report section will also provide an overview of additional MaineDOT transportation safety initiatives including development of an inter-agency comprehensive Strategic Highway Safety Plan.

3.1 Social & Economic Impact

Motor vehicle crashes in Maine result in significant economic and societal impacts. The economic impact of crashes occurring on public roads in Maine in 2004 was nearly \$1.2 billion. This represents about a 10% reduction in economic impact over the past 10 years (economic values are not adjusted for inflation or increased medical costs over the years) and can be attributed to improved roads and safer vehicles. This is during a period when total miles traveled on Maine roads increased by 19%. However, crashes have a deeper effect than estimated economic impact - the toll taken on families and friends who have lost loved ones is immeasurable.

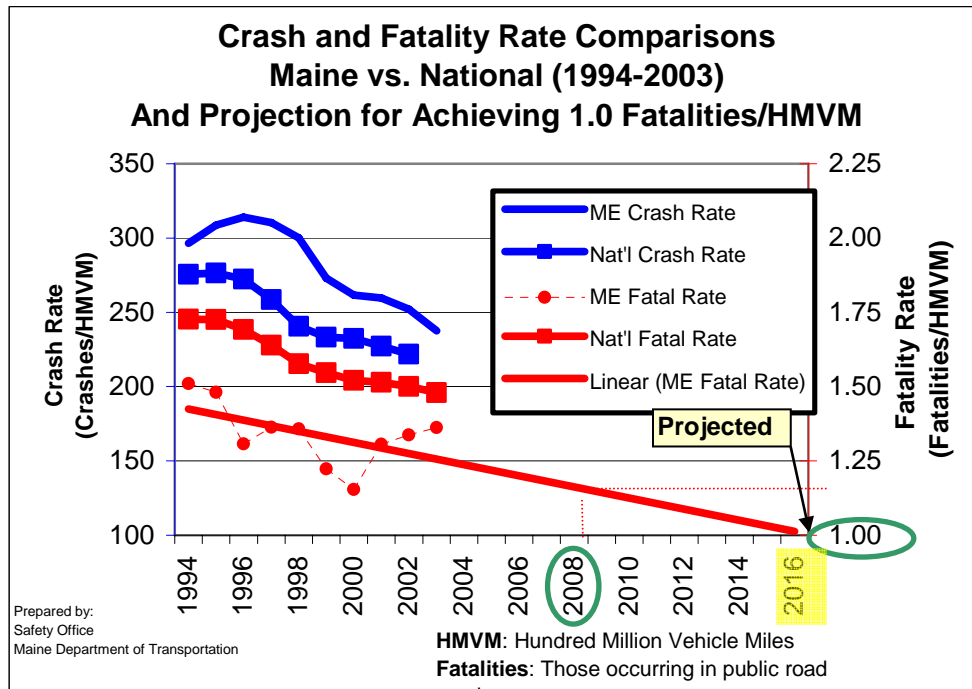
3.2 National Comparisons

Maine's 2004 crash rate, expressed as the number of crashes per hundred million vehicle miles traveled (HMVM) was 237, higher than the latest available national rate in 2003 of 220. Maine's crash rate dropped about 20% from 1995 to 2003. National trends also improved during this period-see figure 3.1.

Highway fatalities on Maine public roads reached a recent high of 204 in 2003 and did decline to 192 in 2004. The 10-year low was 165 fatalities in 2000. There are several leading transportation safety issues that significantly contribute to the number of fatalities, and these will be further addressed in section 3.4. Maine has a crash rate above the national average, but its fatality rate of 1.29 is lower than the national average of 1.46. Maine's fatality rate has dropped 12.8% over the past ten years. Maine ranked 26th in state traffic fatality rates in the latest 2002 comparative listing.

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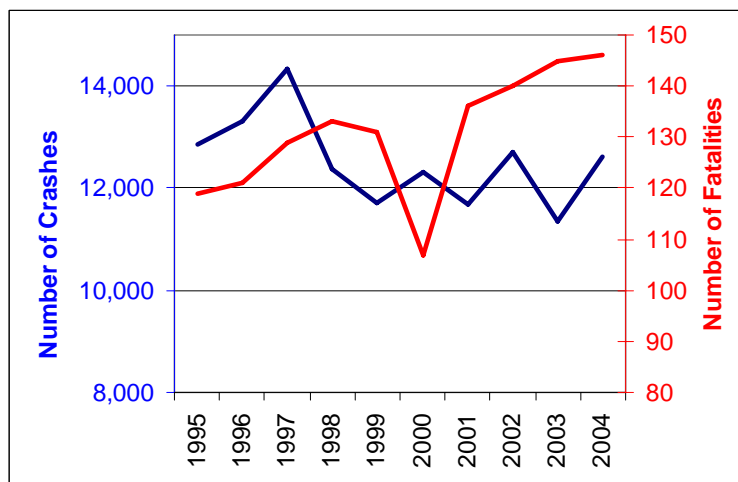
Figure 3.1



3.3 Trends

The state's leading fatal crash type is Lane Departure (Head On and Run off Road) crashes. There were 12,622 Lane Departure crashes (36% of total crashes) that resulted in 146 fatalities (**76% of total fatalities**) in 2004. Unsafe speed is a contributing factor in more than half of rural Run off Road fatal crashes. Crashes are trending down slightly, but fatalities are trending higher (figure 3.2).

Figure 3.2 Lane Departure Crashes and Fatalities



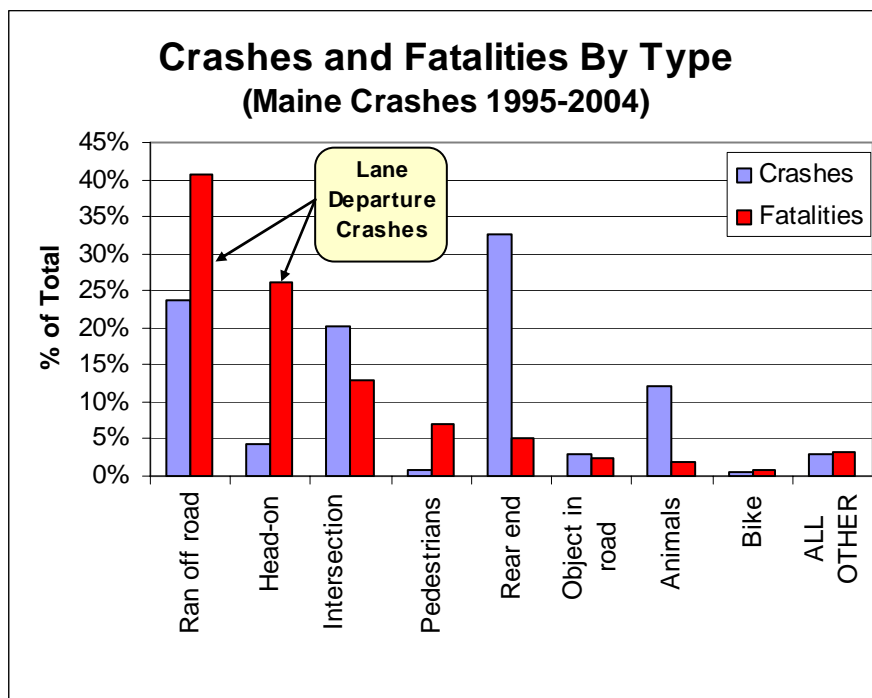
A significant concern related to Run off Road crashes is striking fixed objects including trees, utility poles, and ledge on roadsides that present a serious hazard to vehicles and their occupants. In 2004, there were over 11,000 crashes where a fixed object was struck resulting in 96 fatalities. Figure 3.3 below summarizes the top types of objects struck. Trees are the most frequent fatal object struck, followed

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closely by banks and ditches. Utility poles are third in frequency and resulting deaths. As MaineDOT undertakes transportation projects, utility pole locations are reviewed with respect to the current policy. To further evaluate location and corridor utility pole crash problems, crash maps can now be generated for utility companies to identify where utility pole relocations are needed most. MaineDOT has stepped up its program to improve pole location offsets, making improvements on more miles of highway each year.

Another fixed object concern is rigid guardrail ends. An ongoing guardrail improvement program is underway to help minimize the crash severity of vehicles that strike guardrail ends.

Figure 3.3



Nineteen percent of Maine's crashes occur on wintry road surfaces. From 2002-04, over 20,000 crashes occurred on snowy, slushy or icy roads, and these crashes resulted in 66 fatalities. Illegal/Unsafe speed were noted in about 9,500 of the police crash reports and resulted in 38 fatalities.

Crash and fatality data for the most severe crash types from 1995-2004 are shown in figure 3.3. Rural and urban crash type trends differ. Not surprisingly, Run off Road crashes are the most prevalent in rural areas, while Rear End and Intersection crashes are most common in urban locations. Head On crashes represent just 4% of total crashes, but are a severe crash type, accounting for over 25% of all fatalities. Head On crashes tend to be more severe than other crash types due to the combined forces of the opposing vehicles.

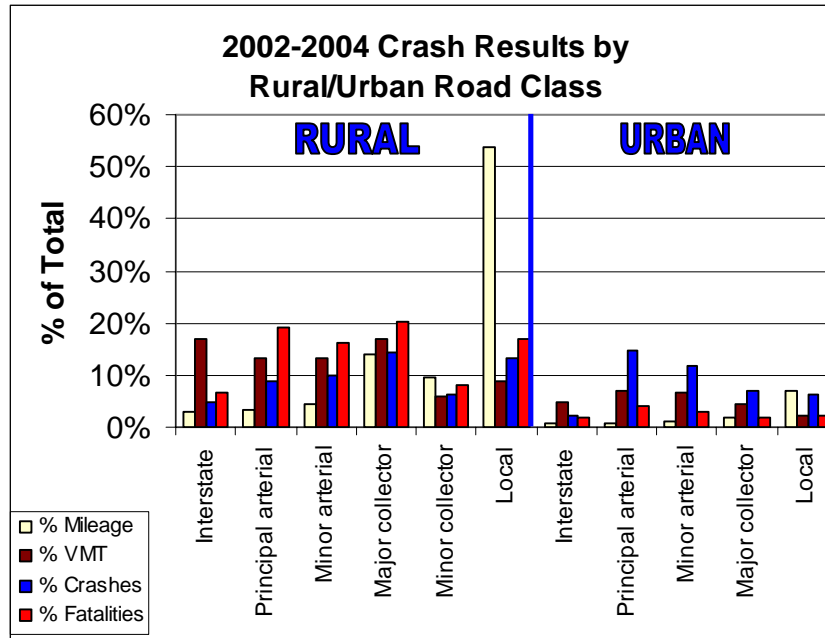
Relative Safety by Road Classification

Maine is a rural state, and this is reflected in the higher number of rural road crashes and their human toll. In Maine, 57% of the crashes and 87% of the resulting fatalities occur on rural roads (2002-04 data). The percentage of fatalities and total economic losses are significantly greater in rural settings for any given road class.

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Interstate roads are the safest roads in Maine, as is illustrated in figure 3.4. This is primarily because the interstate system is designed to a high standard including significant clear zones along the roadside. Clear zones are roadside areas free of obstacles that also allow vehicle recovery. MaineDOT continues to improve clear zones on non-interstate roadsides to provide improved ability for vehicles to safely recover from problems. Close roadside proximity of trees, utility poles, culvert ends, embankments and stone/ledge all are evaluated in project design. Also, the interstate roads are divided and have controlled access, so there are few traffic conflicts. Vehicles travel in the same direction and side friction is introduced only periodically at on and off ramps and when lane change maneuvers occur.

Figure 3.4



Local roads exhibit the greatest ratio of crashes and fatalities per mile driven for both urban and rural road classes. This is likely due to the additional traffic conflicts caused by stopping vehicles, turning traffic and lower design standards (local roads are not designed to the standards as state roads). Local roads account for approximately 60% of the total public road mileage in Maine but only 10% of the vehicle miles traveled.

Leading Driver Contributing Factors

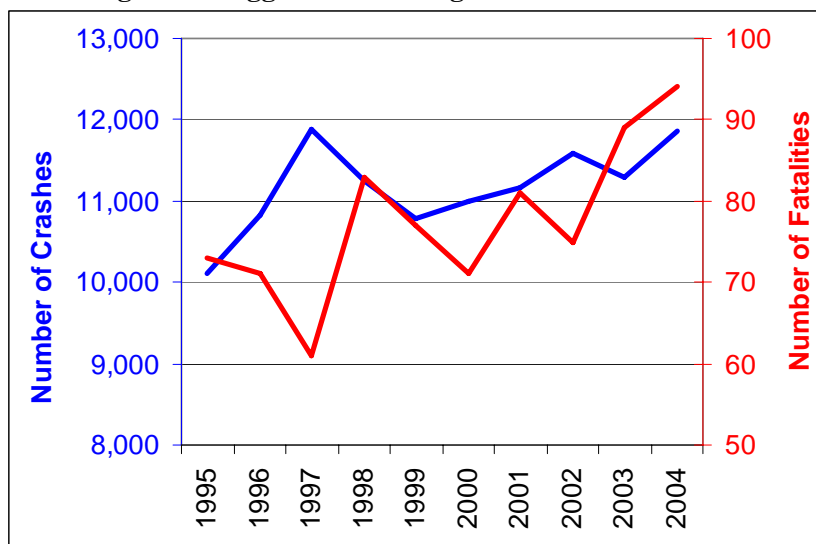
MaineDOT continually looks at improving road design to improve safety; however, driver behavior is often the underlying story of crash causation. The primary contributing factors (driver elements) for crashes in Maine are Driver Inattention (38%), Illegal or Unsafe Speed (17%), Failure to Yield Right of Way (15%) and Following Too Close (9%). Illegal/Unsafe Speed is the deadliest contributing factor, related to nearly 40% of Maine's traffic fatalities. Failure to Yield crashes may sometimes be the result of limited sight distances at intersections or difficulties for drivers to identify an upcoming intersection both of which can be improved with engineering solutions; but also, there are often other contributing factors related to driver behaviors.

Aggressive driving considers several factors where risky behaviors are cited in police crash reports (Disregard of Traffic Control Device; Following Too Close; Illegal or Unsafe Speed; Improper Passing; or Improper, Unsafe Lane Change). There has been an increasing trend of Aggressive Driving crashes in Maine (see figure 3.6 below). Aggressive driving as a proportion of total crashes (especially Speed-related) continues to grow – now at 33.7% (was 31.9% - 2003; 31.4% - 2002) of total crashes and 49% of total fatalities (38.3%-2002; 43.6% - 2003.) Speed is the leading Aggressive Driving concern. In 2004,

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there were 6,611 Speed-related crashes, resulting in 83 fatalities (compared to the annual fatality average of 66 during 2000-02).

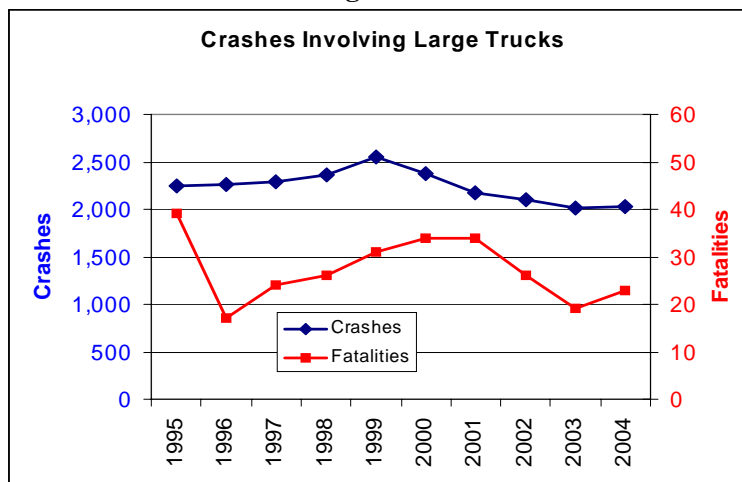
Figure 3.5 Aggressive Driving Crashes and Fatalities



Commercial Vehicle Safety

In 2004, there were over 2,032 crashes involving large commercial trucks (not including vans or pick-up trucks) on Maine's public roads. This number is down from the 10 year high of 2,550 crashes in 1999 (figure 3.6). Increased numbers of larger trucks/tractor trailers are being used primarily because they can carry additional weight. Their axle configuration actually decreases road wear. A typical six-axle vehicle carrying 100,000 pounds causes about 7% less pavement consumption than a five-axle trailer carrying 88,000 (maximum allowed for some special commodities such as concrete products, pulp wood, logs, wood chips or farm produce). (Note: Neither of the vehicles described would be allowed on Maine Interstates, but they would be allowed on the Maine Turnpike.) The result of this shift to larger truck combinations is that fewer vehicles can carry more product with less road degradation, and also an overall decrease in truck units on the road. Although these trucks are less problematic in terms of impact to the road, safety implications are likely to arise and will require close monitoring. Commercial vehicle use is expected to grow well into the foreseeable future, though truck-to-train intermodal facilities have also increased in use.

Figure 3.6



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Bicycle and Pedestrian Safety

Both bicycle and pedestrian crashes have decreased over the last 10 years. This decrease in crash frequency is probably due to two factors. The first is that there may simply be fewer people bicycling and walking. However, it is also fair to assume that part of this decrease is due to construction of better facilities through paved shoulders, sidewalks, and shared use paths, as well as extensive outreach in bicycle safety education in Maine schools and promotion of a “Share the Road” ethic through advertising and signage. Safety for this traveling segment will continue to be addressed as biking and walking activities are advocated to improve public wellness.

Figure 3.7

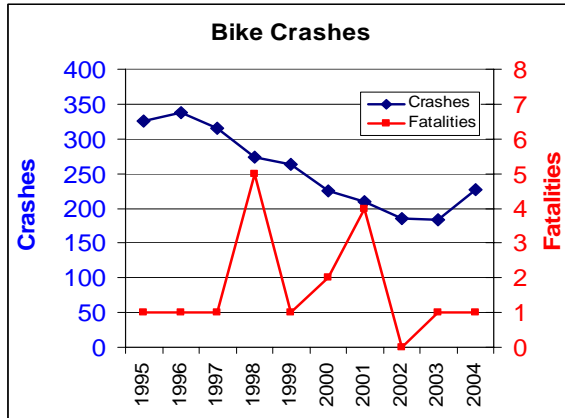
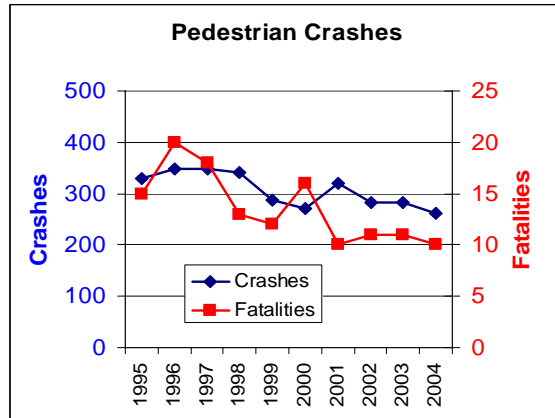


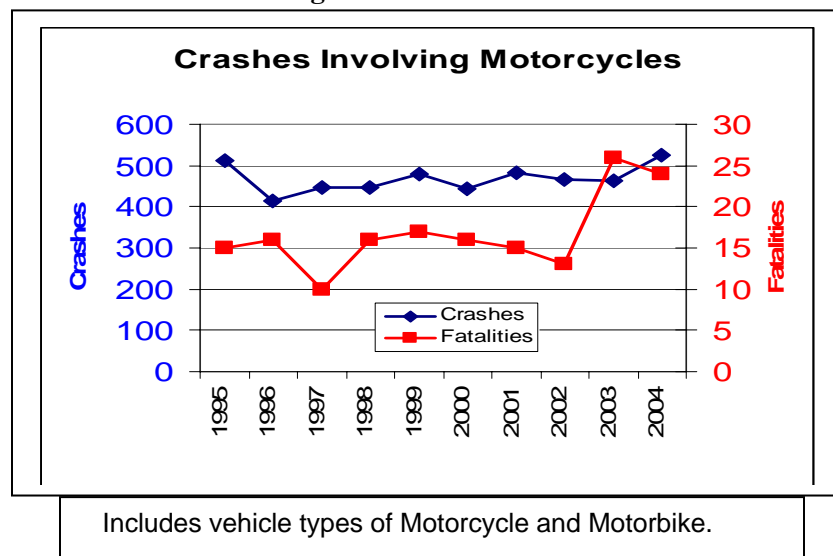
Figure 3.8



Motorcycle Safety

Motorcycle crashes have resulted in increased fatalities during the last two years. This follows a national trend showing an increase in rider deaths. The leading age group of motorcycle fatalities is 45 to 54 year olds, followed closely by 35-44, 16-24, and 65+ year olds. This reflects a continuing upward shift of driver age related to motorcycle operation and crash involvement similar to what is being seen nationwide.

Figure 3.9



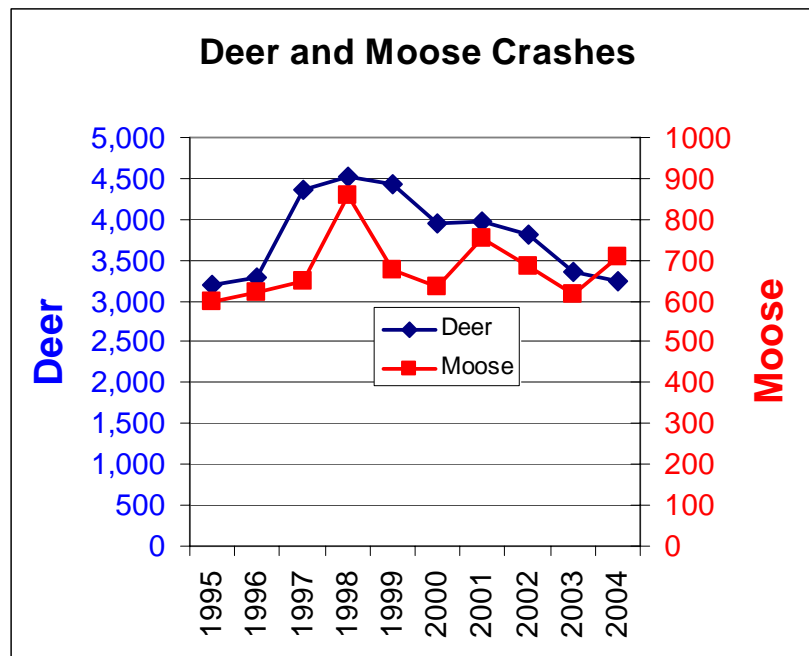
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Crashes with Animals

Collisions with moose increased from 596 in 1995 to 707 in 2004. The number of crashes involving deer trended up, then back down during the past 10 years, with crashes for 2004 being slightly higher (3,203 in 1995 compared to 3,246 in 2004). From 2002 through 2004, there were 9 fatalities resulting from moose crashes and 2 from crashes with deer. (Figure 3.10)

MaineDOT is working with the Maine Department of Inland Fisheries and Wildlife, the Office of the Secretary of State, the Department of Public Safety, Maine State Police, MTA and others to address concerns resulting from crashes involving large animals, particularly moose. Through this group, a short video was produced on crashes involving moose for inclusion in all driver education courses. A new version of a Moose and Deer safety brochure has been produced, as well as an updated Moose and Deer crash map. In addition to these public outreach activities, MaineDOT intends to continue participating with the multi-agency work group and has been implementing pilot projects in efforts to reduce the number of crashes involving large animals.

Figure 3.10

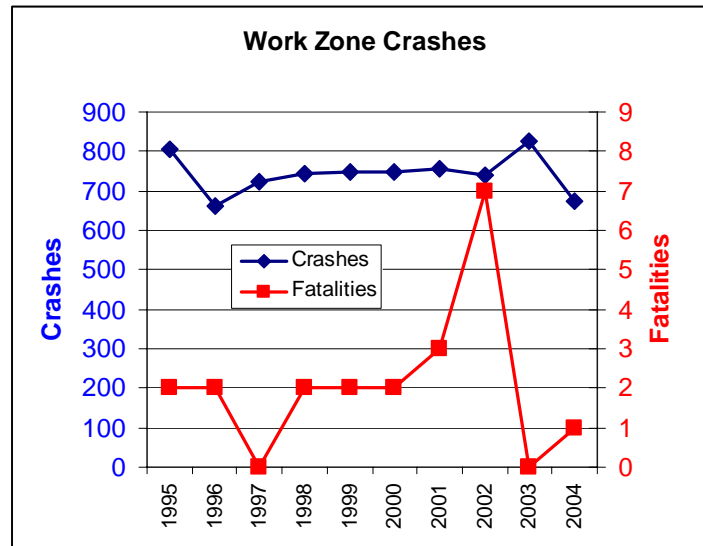


Work Zone Crashes

Maine experiences about 700 crashes in roadway construction, maintenance and utility work zones each year. These crashes have resulted in 21 fatalities during the past 10 years. Workers in these zones are particularly vulnerable, but drivers too are at risk, and actually are more often injured in Work Zone crashes. MaineDOT's Safety Office has ongoing efforts to make sure that Work Zones are safe for MaineDOT employees, contractors and others working in these areas, as well as for the traveling public.

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Figure 3.11



3.4 Maine's Strategic Highway Safety Plan

Traffic safety has many stakeholders, including MaineDOT. In late 2004, various state agencies and other safety advocates embarked on a coordinated effort that combines resources to develop common strategies to address Maine's leading safety concerns. This coordinated approach is intended to bring focus, efficiency, and common messages to the state's road users. Four core safety concerns have been identified: **Seat Belt Usage; Lane Departure Crashes; Aggressive Driving; and Older/Younger Drivers**. Each focus area considers the USDOT "4 E's" approach to highway safety—**E**ngineering, **E**nforcement, **E**ducation, and **E**mergency Services. The Engineering aspect is automatically considered part of MaineDOT's role, but MaineDOT is involved in the other three "E's" as well.

MaineDOT works with several interagency groups including the Maine Transportation Safety Coalition (MTSC). The MTSC is the largest, most comprehensive safety organization in Maine counting among its members many state agencies and private entities. MaineDOT helped lead the production of MTSC's comprehensive state crash report titled **The Status of Transportation Safety in Maine** and its subsequent annual updates. This crash data analysis is an important ingredient in identifying priority safety needs and monitoring performance.

Lane Departure is the most engineering-focused of the four core safety concerns. Corridors having higher concentration of lane departure crashes have been identified and are undergoing an intensive Road Safety Analysis that will target the best improvement strategies and determine the most cost beneficial safety project locations. Safety improvements may include such elements as improved signs and pavement markings, the use of Intelligent Transportation Systems (ITS), improved shoulders, curve redesign (such as increased radius or improved super-elevation), traffic calming, rumble strips, creating safer passing zones and providing roadside areas of safe refuge (for emergencies and speed enforcement). Related Enforcement and Education strategies will also be addressed.

Public Awareness Initiatives

In 2002, MaineDOT launched a media campaign in partnership with TV stations in major media markets intended to increase public awareness on the various issues affecting transportation safety in Maine. Over time, this increased public awareness has aimed to change driver behavior and attitude, resulting in

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improvements to transportation safety in Maine. MaineDOT employs the slogan “Be A Road Model” to capture the need for all drivers to be a positive example on the road and to their young passengers who may be taking future cues on how to drive safely. This federally funded media effort is an important aspect of improving safety, since more than 80% of all police accident reports indicate some form of human error.

Since 2001, MaineDOT has also conducted successful Work Zone Safety Awareness Week public awareness activities including a well publicized Design-A-Poster contest that each year generates hundreds of entries from Maine fourth graders; a MaineDOT employee contest; and a general public contest. The emphasis of this program is to protect both workers and motorists in highway work zones by raising everyone’s awareness of workzones.

3.5 Hazard Elimination Program

The Hazard Elimination Program (HEP) funds projects whose primary purpose is to improve road safety. The HEP currently addresses two road safety areas:

- Existing high hazard locations
- Areas not meeting minimum safety standards

To address existing high hazard locations, MaineDOT maintains a statewide crash database. Each year, statewide average crash rates are calculated for various road classifications and urban/rural designations. High hazard locations are identified by comparing all locations to the appropriate statewide average crash rate. Those locations exhibiting a statistically significant higher crash rate than the average (for all other similar locations with similar traffic exposure) and that have experienced at least eight crashes within the most recent three-year period are termed High Crash Locations (HCLs).

Filters such as crash rate, severity, economic value and identified patterns are applied to all crash locations, including HCLs, to obtain a manageable number of candidate projects. Municipal and general public requests for safety projects are also considered. Of the prioritized list of locations, 75 are typically reviewed each year. Life cycle cost for capital improvements are compared to anticipated injury cost reductions. Those locations exhibiting the greatest crash cost reduction (benefit) to life cycle (capital plus operational) cost get funded first. Thus, eligible projects are ranked in descending order and funded until all funds are depleted. Project opportunities that are related to improving results in identified core areas of Maine’s Strategic Highway Safety Plan are also sought.

The HEP is used to address locations that do not meet minimum safety standards. These are systemic enhancements shown to have high benefit-to-cost ratios, such as guardrail improvements.

By federal regulation, the HEP must be directed to all public roads, including local roads. The federal participation rate is 90%. State money is used for the 10% match, except when municipalities provide the 10% match for projects on their local roads. Recent projects include intersection improvements such as traffic signal installations or upgrades, realignment and lane additions. Non-intersection improvements have included roadside clear zone improvements and guardrail upgrades.

Completed projects are reviewed for safety performance, comparing crash and related injury experience for 3 years before to 3 years after. A Benefit-to-Cost Ratio over 1.0 reflects a good return on investment. The latest review of HEP project performance shows an overall Benefit-to-Cost Ratio of 8.18 for projects completed between 1997 and 2000. The overall crash reduction resulting from completed projects in this time period is 32.2%. The overall reduction in the economic impact of those crashes is 63.5%. These reviews also provide MaineDOT an indication of what types of projects offer the best safety return.

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3.6 Funding Scenarios and Implications

Further discussions on needed funding are found in Section 3.7 Conclusions below. To achieve system safety needs and bring about the targeted goals to preserve life and prevent economic loss on our highways, significant resources are required. Additional funding would be expended in areas that would have the most impact on saving lives. Two leading areas where increased funding can yield significant safety performance improvements are:

Lane Departure crash mitigation strategies (See related possible safety improvements listed below). This crash type results in 70%+ of Maine's fatalities; and

Public Outreach (Since the underlying cause of crashes almost always has a driver behavior element). Strategies to bring about changes to improve poor driving behaviors are extremely important, but influencing driver behavior is a difficult challenge. A plan needs to be developed that helps affect the underlying risk taking tendencies in drivers, and that reaches all ages. Behaviors are molded at a very early age, so outreach should be further built upon the fourth grade Work Zone Awareness program that MaineDOT has initiated, and be further emphasized through driver's education and beyond for the experienced driver. Such an effort should be a cooperative venture with key safety stakeholders including Department of Public Safety/Bureau of Highway Safety, BMV, Department of Health, MTA and others.

3.7 Conclusions

3.12 Maine's Transportation Safety Needs (in millions of 2005 dollars)

Safety	2002-2003	2004-2005	2006-2007	STATUS QUO Investment Level (Average Over 3 Biennia)	To Maintain Constant Performance/Condition	Biennial Strategic Need
Hazard Elimination	5.3	6.4	8.5	6.7	6.0	9.0
Rail Highway Crossings	2.1	2.5	2.1	2.2	2.2	2.4
TEA-21/SAFETEA ¹	1.4	0.9	TBD	1.1	1.0	3.5
Safe Ways to School	0.0	0.0	0.6	0.6	0.6	2.0
Total:	8.8	9.8	11.2	10.6	9.8	16.9

MaineDOT's safety efforts have been effective. MaineDOT's application of funds to dedicated safety projects have been successful, reducing crashes at safety project locations by 32% and reducing by 63.5% the injury-based economic impact estimate.

Crash and fatality rates have dropped 20% and 12.8% respectively during the past 10 years. Despite this improvement, there is still a public call for traffic safety improvement. The strategic funding need reflected in the above chart is largely related to addressing the national goal of reducing the state's fatality rate to 1.0 fatalities per hundred million vehicle miles by **2008**. Maine is currently at a fatality rate 1.31. At the current funding level it is projected that the 1.0 fatality rate objective would not be met until **2016**.

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Lane Departure crashes continue at a high rate, with this crash type responsible for over 70% of the state's traffic fatalities. Corridor improvements to bring about crash and fatality reductions can be effective, but costly. To make a meaningful difference in Maine's fatality rate, improvements must be made in this leading fatal crash type. Road system enhancements could include: improved shoulders; safe roadside recovery design; increased curve radius and improved super-elevations; other road treatments/traffic calming applications; guardrails; signing including Intelligent Transportation Systems applications that could provide driver feedback on speed, road and traffic conditions; creating safer passing zones; and providing roadside areas of safe refuge to handle roadside emergencies as well as locations from which speed enforcement could be safely administered.

Actions aimed at mitigating Lane Departure crash causal factors (speed, other aggressive driving tendencies, and distraction) are also needed. Therefore, an essential ingredient to achieving traffic safety improvement is influencing driver behavior; that would be accomplished through various forms of **Public Outreach and Education** - funded through both the Work Plan and SAFETEA (federally funded).

Average rail crossing conditions are declining and an aggressive plan to upgrade these and reverse the deteriorating trend is reflected in the strategic need funding target.

MaineDOT is currently well-positioned to address these safety needs. A Safety Office has recently been established, and is working with other state agencies and safety stakeholders to direct the safety agenda in a coordinated manner. Analysis of Maine's crash activity continues, bringing 4 core safety topics to the forefront: Lane Departure Crashes, Seat Belts, Younger and Older Drivers, and Aggressive Driving. Looking ahead, the following are the lead recommendations for success:

Continued dedication to building a coalition of state agencies and other safety advocates to jointly address the State's transportation safety needs.

Coordinated efforts within MaineDOT – Planning, Project Development, Maintenance and Operations, Traffic Engineering, Bridge, Safety and others to ensure that safety is a planning-to-pavement activity.

Continued analysis of Maine's crash performance.

Continued identification and prioritized selection of locations of safety need, and application of funds to make cost-beneficial improvements. Past efforts have largely focused on intersections. Increased attention to strategies and techniques to reduce Run Off Road and Head On collisions is needed.

Outreach and support to local municipalities, since 20% of the crashes and fatalities occur on local roads (nearly 30% of total Lane Departure crashes).

Ongoing assessment of best mitigating techniques to enhance safety in all areas.

Further emphasis on conducting Road Safety Analysis to identify safety needs to integrate into the project scoping process.

Use of ITS to better inform drivers of road conditions and help improve driver decision making.

Much of the safety problem is not directly road-related, but rather driver behavior. Two areas that MaineDOT can support are:

- **Enforcement** – MaineDOT can provide police agencies information on speed – related crashes to help focus on areas of needed enforcement.
- **Education** – includes driver education, general public outreach, and media messages. There is interest from several agencies in partnering on this effort, which would best utilize financial and human resources to create a quality, effective product.